

International comparison on the management system of end-of-life vehicles

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Abstract. With the rapid development of economy, Chinese vehicle ownership has risen significantly. At the same time, the end-of-life vehicles put a huge pressure to energy and environment, which will finally have an extremely bad effect on sustainable development of economy. The paper takes the United States, the European Union and Japan as samples, compares and analyses these countries' experiences in law, administration, operation. The key of developed country governance to solve 'trust' problem in recycling is its diversity within a complete legal system. At last, the paper gives some suggestions on the issue of Chinese end-of-life vehicles recycling.

1. Introduction

'Trust' problem is the key problem in the reproduction and remanufacture of end-of-life car. These cars must be effectively degraded into renewable substances before they are reproduced and remanufactured. In this way, they can provide a reliable basis for quality of new products. Developed country establishes a strong system to solve such problems. America is most productive and consumption nation of automobiles all over the world. They scrap more than 10 million vehicles every year. As the third economic heavyweight all over world, Japan is also a productive and consumption nation of automobiles. They scrap about 5 million vehicles every year. All the European Union has been in 'Vehicle Society'. Just in 2002, they scrapped almost 9 million vehicles. China end-of-life vehicle market started quietly and the quantity of cars was expected to reach from 12 to 16 million at 2020.

At Special Press Conference on Automobile Circulation Development Promoting Green & Circular Consumption, spokesman for Ministry of Commerce Yao Jian pointed out that by the end of 2012, the vehicle ownership in China had exceeded 0.12 billion. He estimated that by the end of 2015 and 2020, the number would increase to 0.15 billion and 0.2 billion. Such huge inventory and demand size indicates that automobile market is gradually forging into the peak time of renewal. According to China statistical yearbook, the growth trend of China privately owned automobile from 1995 to 2014 is shown as Fig. 1.1. From the diagram it can be concluded that over the 20 past year China private vehicle ownership increased sharply. The yearly growth rate exceeded 15 percent. With the sharp increase of vehicle ownership, the amount of end-of-life vehicle is continuously increasing.



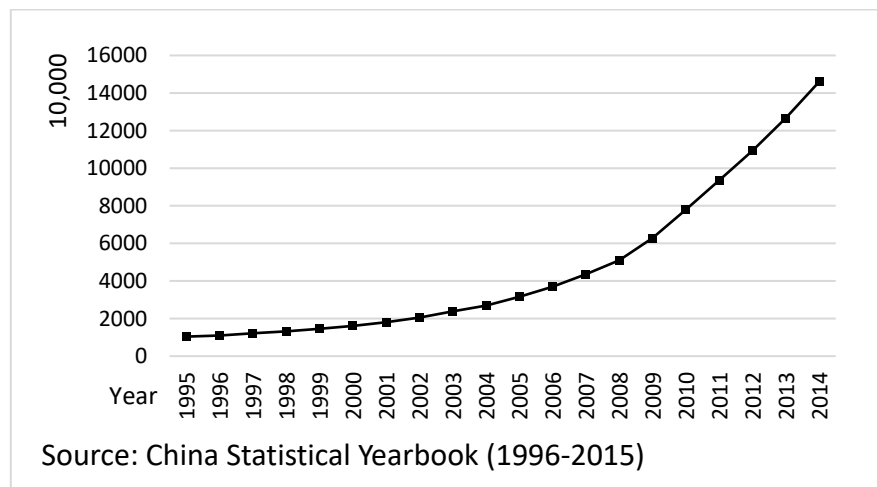


Fig. 1.1 Trend of China's motor vehicle's number 1995~2014

The countries which have developed automobile industry met problems of end-of-life vehicles in advance. After many years' discovery and practice, they have a lot of experience of how to use macro-economic control and market allocating resource to manage end-of-life vehicles effectively. The core problem of recycling and managing end-of-life vehicles is how to select management measures. Since there are multiple ways to facilitate end-of-life vehicles recycle and management, we can classify them with different standards^[1]. In this part, we discuss the problem through legal and policy measure.

2. Legislation restriction

2.1. United States – Indirect Legislation Restrictions

With the increased harm caused by end-of-life vehicle, American government tried to take serious actions since the nineteen nineties. They legislated complete laws and regulations about environment protection and production joint liability. But they didn't have special national end-of-life recycling regulations. End-of-life recycling regulations should obey the following government laws, The Ministry of transportation vehicle recalling law, the Ministry of Commerce car insurance usage law, the Ministry of energy average fuel consumption law, EPA emissions law and so on.

In 1991, America firstly legislated the law to facilitate recycling wasted tyre. In 1994, government ruled that asphalt highway which was funded by government must contain 5% rubber particles. These rubber particles were made by old tyres. After implementing the regulation, asphalt highways contained rubber particles in America have already exceeded 11 thousand kilometers. Asphalt Pavement can be anti-aging by using rubber particles. Besides, it can make road surface be more elastic and extend lifespan. Moreover, according to the related law, the vehicle accessory can be use again only if it doesn't reach the years that to be completely abandoned and affect normal use. All of these laws facilitate the development of American end-of-life vehicle recycling.

With the strict environmental protection regulations, American consumers can't abandon cars anywhere. Usually, they will give end-of-life car to car dismantling enterprises voluntarily. Production joint liability means that in a manufacturing chain, some or all of the producers and sellers should share associative responsibility for the losses caused by the production that is dangerous in manufacture and sale or defective products^[2]. Such product liability regulations promote the entire automotive production supply chain to participate in the research of end-of-life car recycling, making the end-of-life cars become a higher residual value of material resources in the United States. End-of-life can be recycled in market-oriented mode.

2.2. Japan – Completed recycling regulation and effective processed operating procedure

Since 1970s, Japan began to build a recycling economy system to get rid of mass production, consumption and waste-based development model. They use the end-of-life products as resources to

recycle them effectively and establish a basic legal system to promote recycling-oriented society. They also clearly defined the obligation of automobile manufacturers, importers and vehicle owners.

In May 1997, the METI promulgated the "Rules for the Regeneration of Used Vehicles" on the basis of the Report of the Council on Economic and Industrial Structure. The main objective of the law is to reduce the use of hazardous substances, reduce debris and improve the reusability. Meanwhile, it also plays the following roles.

Improve the original processing channels and make it more efficient. For example, in order to prevent illegal discard, they established the upper and lower processes to manage note and strengthened the penalty of illegal discard.

They complete the information exchange between relevant departments and make the work more efficient. They also clarified the obligations of the automobile manufacturers and the relevant departments of the government, local governments, distributors, disintegration and crusher employees. In addition, it also emphasized the following two points: Establish end-of-life vehicle recycling support center. This center can not only strengthen information exchange with relevant department, but also can improve the recycling rate of technology development. In new car design respect, fully considering the easy decomposition, easy recycling of the structure and selection and improvement of plastic design, which is aim at the waste plastics that take up 50% of the current debris.

In 2004, Japan revised the Law of Registration of Vehicle Cancellation, and strengthened information management of updated vehicles from all aspects of vehicle registration and cancellation. It also promoted the recycling, dismantling and comprehensive utilization of end-of-life vehicles.

2.3. European Union – Legislation from the root

On 18 September 2000, the European Parliament and the European Council passed legislation to implement the "Directive on End-of-Life Vehicles (2000/53 / EC)", which was used as a legislation of Member States in 2001.

Directive made a series of regulations on the disposal of end-of-life vehicles, recycling rate, vehicle free recycling, etc. to promote the development of end-of-life vehicles recycling. The EU was also released "Directive 2005/64/EC on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability" in 2005. The directive was based on the "Directive 2000/53/EC on end-of life vehicles" and brought category M1 or N1 into administration and technical regulation of EU type certification system. The Directive explicitly requires individual vehicle manufacturers to collect information from the entire supply chain as well.

The Directive has become the basis for the EU members to develop end-of-life vehicles recycling regulations. The relevant regulations legislated by the Member States are based on Directives (Table 2.1).

Table 2.1 Relevant Regulations of End-of-Life Vehicles Recycling in EU Member States

Country	Release / implementation time	Relevant laws and regulations
Germany	1972	"Waste Disposal Law"
	1996	"Circular Economy and Waste Management Law"
	21 June 2002	"End-Of-Life Vehicle Regulation"
Britain	2003	"End-Of-Life Vehicle Regulation"
		"End-Of-Life Vehicle Regulation 2003"
		"End-of-Life Vehicle (Producer Responsibility) Regulations"
	3 March 2005	"End-Of-Life Vehicle Regulation 2005"
France	August 1, 2003	"Decree on the construction of vehicles and the disposal of motor vehicles"
		"Decree No.2003-727"
Netherlands	24 May 2002	"The Scrap Car Management Act"
		"End-Of-Life Vehicle Management Decree"
Spain	20 December 2002	"ROYAL DECREE 1382/2002"

According to the above directive or law, the main responsibility of the end-of-life vehicle recycling chain is the automobile manufacturer, that is, car manufacturers or importers. The automobile manufacturer connects upstream (parts suppliers) of end-of-life vehicles recycling chain to its downstream (recyclers, dismantlers and crushers), which is the key to end-of-life vehicles recycling. When they produce cars, they are required to achieve the following objectives at least: low energy consumption, easy dismantling, suitable for recycling, reduce toxic substances emissions, etc. To achieve these goals, manufacturers need to understand the appropriate technical and economic means to manufacture vehicle that is easy to be dismantled, recycled and is low-harmful. In addition, the cooperation of the recycler, the dismantler, and the shredder is basis for achieving the Directive.

3. Operation system management

3.1. United States – Fully develop private and business autonomy

In 1994, the first Cooperative Research and Development Agreement (CRAPA) was signed by the Vehicle Recycling Consortium (GM, Ford, DaimlerChrysler), the US Department of Energy's Argonne National Laboratory at the University of Chicago and the American Plastics Institute (APC). Automotive fuel economy, vehicle safety and lightweight materials are listed as mainly studied objectives in the agreement and they reach consensus to share cost and research results. The dismantling of end-of-life vehicle and the recycling of seat foam have made phased research results at the first cooperative research and development agreement.

With the leadership of three American major automobile companies, the US Department of Energy, the Office of the car pre-technology and Argonne National Laboratory jointly developed a "Future End-of-Life Recycling Guide" in 2001, which clearly defined that the US end-of-life recycling rate should reach 95% before 2020. The vehicles that reach the end of life in 2020 are products produced between 2005 and 2010. Steel and aluminum are still the main material components of these vehicles, and thermoplastics are still included in their plastic parts. The Guide assumed that the materials for end-of-life vehicles in 2020 should include 75% metal, 15% plastic and 10% other materials such as glass, liquid and so on. The guide predicted that 10% of end-of-life vehicles would be disassembled, 5% of metal parts would be re-used and remanufactured, and 5% would be recycled. Crushing and material sorting recycling would account for 90% of end-of-life cars, while landfill would only account for 5%.

3.2. Japan – strengthen recycling information system establishment

Japan's management of end-of-life vehicles recycling is carried out through both government and non-governmental organizations. Mainly including the following three points: 1. Increase awareness of consumer protection by levying recycling fees. 2. Establish a fair and transparent electronic inventory system, and increase information management efforts^[3]. 3. Establish a recycling system which is based on the principle of expanding the responsibility of producers.

For the definition of consumer and producer responsibility, the Ministry of Economy, Trade and Industry (METI) examined a wide range of questionnaires on who should take responsibility for the cost of recycling end-of-life vehicles. The result showed that consumers should take this responsibility. Japan adopt levying recycling fee approach to promote the recycling of end-of-life vehicles, which means the money levied from vehicle producers or consumers will pay to end-of-life vehicles recyclers. This will enhance consumers' awareness of resource conservation and environmental protection.

Besides, to the producers, establish recycling mechanism which is based on the principle of expanding producers' responsibility. The system expands the responsibility of car manufacturers. They are not only responsible for the recovery and disposal of ASR, freon and airbags, but also need to ensure that the operation of the entire recycling system should be successful.

3.3. The European Union – Strengthen the control of producers

After the European Commission issued the first directive, the "Directive on End-of-Life Vehicles (2000/53 / EC)" (referred to as "ELV Directive"), in May 2000, they also issued the "Directive 2005/64/EC on the type-approval of motor vehicles with regard to their reusability, recyclability and

recoverability" (referred to as "RRR type certification"), "Motor vehicles with trailers: EC type-approval (70/156/EEC)" revision. The ELV Directive also become an independent directive within the framework of the 70/156 / EEC, the 2009/1 / EC Directive revision and the RRR Type Approval Regulations of 2005/64 / EC, which clearly requires the vehicle companies to collect information from the entire supply chain.

The ELV Directive defines the two-phase target of end-of-life vehicles' "re-use and re-utilize" and "re-use and recycling" in the EU, prohibits or limits the use of four heavy metals (lead, mercury, cadmium and hexavalent chromium) as well. The ELV Directive is composed of 13 parts, which is aim to prevent vehicle waste. It establishes mechanisms for the collection, treatment and reuse of end-of-life vehicles to reduce waste disposal. Besides, it improves the environmental protection effectiveness of all operators involved in the vehicle life cycle.

4. Suggestion to China

As of 2014, China end-of-life vehicle recycling dismantling industry develops steadily. There are 597 companies acquired dismantling qualification in China, which means that end-of-life vehicle recycling network is taking shape. The number and overall quality of recycling dismantling company are increasing gradually. But there are still some problems in our country, such as low recovery, low level enterprise, heavy tax burden and disorder. Besides, the problems are caused by the enterprises' management. It's not suited to social development. And relevant laws also still need to be improved. We have following suggestions:

4.1. Complete for the recycling of end-of-life vehicles standards and regulations

End-of-life vehicle recycling standards and regulatory system should be combined with the characteristics of our country from the design and production of new cars to the maintenance and repair of motor vehicles scrap dismantling and recycling. The scope should be involved in domestic and imported cars. In addition, Chinese auto products and accessories' import and export also need to comply with international laws and regulations.

4.2. As soon as possible to improve the recovery of automotive product standards

Develop automotive product recycling standards as soon as possible, emphasis on environmental design, quantify the use of hazardous substances in product design, and clarify the ban on hazardous substances and the standards that automobile and accessory enterprises that must implement. This can improve the recycling rate of end-of-life vehicles, protect the environment and promote the realization of stage objectives.

4.3. Regulate the end-of-life vehicle recycling management system

Further improve the management system of scrap car recycling, standardize the operation process is focus we need to improve in the recovery of end-of-life vehicles. First of all, we need to clarify that the car manufacturer is the responsibility of the end-of-life vehicle recycling system. The car manufacturers do not only have responsibility for the design of automotive products, but also should be responsible for recycling end-of-life vehicles and disclose vehicle dismantling information. Secondly, the various enterprises in the scrapped car recycling system (Automobile and accessories enterprises recycling dismantling enterprises) should strengthen cooperation to achieve common goals. Besides, we should use foreign advanced technology in the recycling of end-of-life vehicles for reference, such as the EU end-of-life vehicle directive, to further refine the recycling process with a view of China's special circumstances.

4.4. Encourage automotive product recycling technology research

Recycling, dismantling and reuse of end-of-life vehicles is actually an important part of the whole life cycle of product design, production, consumption, and recycling. To improve the product recycling rate, on the one hand, we need to use scientific methods to regulate the scientific recovery dismantling process; On the other hand, to start from the source. That is, at the beginning of product design, we need

to take the performance of the product cost index into account to reduce environmental and energy consumption of components and other recycling problem, so as to design more pollution-free and reusable automobile. Save resources and protect the environment while meet people's needs.

4.5. Identify the responsibilities of all the parties involved in the end-of-life vehicle

Not matter the EU's 'Who manufacture, who is responsible for it', or the Japanese consumer taking whole responsibility, they all clearly defined the responsibility of every party. This avoid shirking the responsibility at the most extent, thus promoting the recovery of end-of-life vehicles. China should strengthen the definition of end-of-life vehicle responsibility so that the end-of-life vehicles can be handled according to the standard procedure.

Acknowledgement

This paper is supported by the Beijing Education Commission project "An empirical study on governance mechanism of environment externality in Beijing urban traffic (2016LJJD-2)" and the Beijing Social Science Association project "Research on the coordination of urban vehicle restriction policy under the integration of BTH(B13H100010)".

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